Resonating-Valence-Bond Ground State in a Large-n t-J Model

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are fermions with enhanced mass. In the electron system the mass enhancement for the excess electrons is even more serious. In both cases a bond pair of such fermions is always formed in the ground state. The bound pair acquires a small mass. Hence the condensed state of the composite bosons, the bound pairs, is achieved in the lower temperature phase. The mass reduction in the pair formation is described by a Gauge force. This is clearly expressed by means of the Schwinger spin bosons. The Gauge force leading to the mass reduction appears in a very local ragion. The asymptotic freedom leads to a partial justification for our mean field picture which neglects the quantum spin fluctuations. The Néel spin pattern in the background may not be a good approximation for $T>T_c$, but in the superconducting phase the spin pattern is almost stabilized through the mass reduction mechanism. The spin pattern violates the time reversal symmetry. As the CPT theorem predicts, there appears a parity violation:The bound pair is a mixture of a symmetric state and an odd parity state. The conventional GL phenomenological theory does not apply to this novel superconductivity.

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To shed light on the roles of hole doping in strongly interacting elctron systems, we study large-n version of the t-J model. When there are holes we prove that a novel resonating-valence-bond(RVB)state, which we call the hopping-dominated RVB (hRVB) state, is the unique ground state. We conjecture the existence of a phase transition between the standard tunneling-dominated phase and the new hopping-dominated phase. By treating the hopping term in the second order perturbation, we get an exactly solvable toy model whose ground state is the nearestneighbor hRVB state.

A Weak Coupling Expansion for the Hubbard Model on a 4×4 Cluster

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The Hubbard model on a 4×4 cluster is studied in the weak coupling limit for half filling one and two holes. In the half filled case and for one hole the quantum numbers of the ground state agree with moderately strong coupling results. In the two hole case, to second order in U, there is more degeneracy than at intermediate coupling. The binding